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Economic Trends and Outlook of Pesticide Industry: Need for 'Exclusive Use' Amendments to FIFRA

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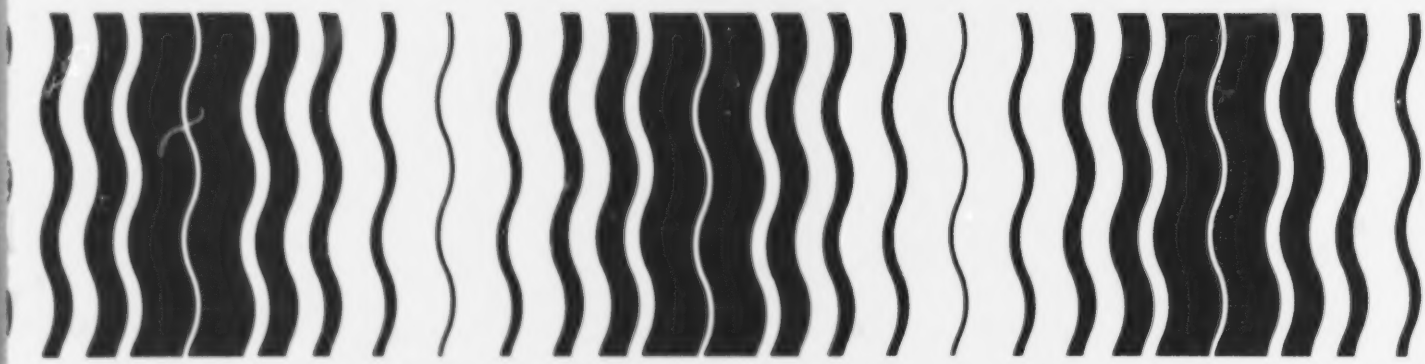

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16. ABSTRACT

This report provides an economic evaluation of pesticide industry trends, outlook and need for exclusive-use-of-data privileges under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Periodically, an exclusive-use amendment to FIFRA is proposed based on the argument that, without such protection, companies conducting pesticide R&D do not have the opportunity to recover their R&D expenses and make acceptable profits on their new products.

To evaluate this contention, data on pesticide production, sales, profitability, industry entrances and exits, and R&D expenditures were analyzed. These data indicated that the pesticide industry is economically dynamic and growing with growth predicted to continue for the forseeable future. Value of sales has increased fourfold during the past decade (from $0.6 billion in 1966 to $2.4 billion in 1976) and is forecast to continue rising. In comparison to other industries, pesticide production was generally a high profit business. Expenditures on pesticide research and development increased by $107.5 million (from $87.7 million in 1971 to $195.2 million in 1976) in a five-year period. In addition, pesticide firms continue to expand their production capacity and the pesticide industry still attracts firms to the industry. Consequently, it was concluded that the industry does not need special market protection from Congress via exclusive-use-of-data privileges.

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a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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ECONOMIC TRENDS AND OUTLOOK OF PESTICIDE INDUSTRY: NEED FOR "EXCLUSIVE USE" AMENDMENTS TO FIFRA

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U.S. ENVIRONMENTAL PROTECTION AGENCY

FEBRUARY 15, 1978

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ECONOMIC TRENDS AND OUTLOOK OF THE PESTICIDE INDUSTRY

INTRODUCTION

Pesticide industry representatives have expressed concern about the effects of government regulation on the industry, particularly on incentives to pursue basic pesticide R&D. During the debate over amendments to FIFRA in 1971-1972 the National Agricultural Chemicals Association (NACA) proposed a provision for exclusive use of data (U.S. Senate, 1977). This provision would have prevented the use of data submitted to EPA by one registrant to support the later application of another registrant.

This proposal was not adopted in the 1972 amendments, but it has been proposed again during the current debate on amendments to FIFRA. The House of Representatives has adopted a modified form of the NACA proposal and has proposed a 5-year period of exclusive use to be followed by a 5-year period of compensation for use of data (see Appendix I for House proposed amendments).

The justification for the exclusive use proposal has been that EPA's practice (prior to 1972) of utilizing all data in its files to process an application was causing pesticide companies to abandon their R&D programs. This argument implies that, without an exclusive use provision acting as a barrier to entry to other firms, companies conducting pesticide R&D did not have the opportunity to recover their R&D expenses and make acceptable profits on their new products.

This report provides an economic evaluation of pesticide industry trends and outlook, and its need for exclusive-use-of-data privileges under FIFRA. Data on pesticide production, sales, profitability, industry entrances and exits, and R&D expenditures have been utilized in the analysis.

SUMMARY AND CONCLUSIONS

The pesticide industry is an economically dynamic and growing one, with growth predicted to continue for the forseeable future. Pesticide manufacturers are generally part of larger chemical corporations, which have collectively enjoyed higher profits over the past five years than the average industry. Value of sales has increased fourfold during the past decade and is forecast to continue rising in the future.

In addition, expenditures on pesticide research and development have been rising at a faster rate than in U.S. industry generally, pesticide firms continue to expand their production capacity, and the pesticide industry is still attracting firms to the industry. Consequently, it is apparent that the industry does not need special market protection from Congress.

The argument for needing an exclusive-use-of-data provision in FIFRA is not persuasive. It ignores the fact that other forms of protection, e.g., patent protection, exist to give a company introducing a new product to the market fair chance to recover its investment cost without threat of competition. Thus, contrary to implication, exclusive use is not the only competitive protection available to a company. Rather, it is a supplementary barrier to entry which extends protection past the patent period or provides protection to products which don't have patent protection.

In addition, the implied negative effects on the pesticide industry are contradicted by the industry's recent history and projections for the future. Between 1967 and 1971, pesticide industry R&D expenditures increased by approximatley 35 million dollars (from 52.4 million dollars in 1967 to 87.7 million dollars in 1971) (NACA, 1970, 1975). Between 1971 and 1976, pesticide R&D expenditures continued to increase, by 107.5 million dollars (from 87.7 million dollars in 1971 to 195.2 million dollars in 1976) (NACA, 1975, 1976). Consequently, an exclusive-use-of-data provision in FIFRA was not needed in 1972 and is not needed today.

Furthermore, not only does the industry not need an exclusive-use provision, but industry competition and economic performance would be adversely affected by exclusive use or related provisions if added to FIFRA.

The major conclusions and more detailed findings are presented in the tabular summary on the following page.

ECONOMIC TRENDS AND OUTLOOK OF THE PESTICIDE INDUSTRY

SUMMARY OF FINDINGS

THE PESTICIDE INDUSTRY IS A GROWING DYNAMIC ONE.

U.S. Production:
- Upward trend during last decade
- Future growth projected (6-8%/yr.)

Sales:
- U.S. annual sales trended upward during last decade (one-third higher in 1970's than late 1960's)
- Both world and U.S. markets are strong with the former to experience faster growth rate (24 percent, 1980-84)
- Growth in domestic sales due largely to existing markets, rather than new market segments, (e.g., pre-emergence herbicides).
- Supply/demand balance has been quite satisfactory despite year-to-year variations in demand, energy crisis, etc.
- Market growth favors economically healthy industry, capable of meeting safety requirements, R&D costs, etc.

THE PESTICIDE PRODUCTION INDUSTRY IS ECONOMICALLY HEALTHY.

Profits:
- Pesticides production is generally a high profit business compared to other industries.
- Major firms have generally good profit record since 1972.

Industry turn-over:
- No trend toward net exit or entry of firms in pesticide production (2 or 3 percent turn-over per year).

Competition:
- Major share of producing industry is concentrated among relatively few large firms (e.g., 7 firms account for 63 percent of sales).
- High levels of concentration at market and submarket levels, i.e., oligopoly.

R&D:
- Basic R&D tends to be concentrated among relatively few firms (e.g., 7 firms account for 50% of total R&D).
- R&D in pesticides is not trending downward and is a higher percent of sales than other U.S. industries (e.g., about twice the percent of sales of industry generally).
- R&D is shifting toward expanded use of existing chemicals, rather than more speculative new chemicals.

SPECIAL MARKET PROTECTION FOR PESTICIDE PRODUCERS IS NOT JUSTIFIED ON ECONOMIC GROUNDS.

Competition:
- Industry is highly concentrated and competition would be further reduced by "exclusive use" provisions if added to FIFRA.

R&D Costs:
- Exclusive use provision would add to industry R&D costs, due to duplication of effort among firms.

Consumer impacts:
- Consumer would experience adverse economic effects in form of higher prices, restricted supplies and/or more limited choice of pesticides.

U.S. PESTICIDE INDUSTRY PRODUCTION AND SALES

Production

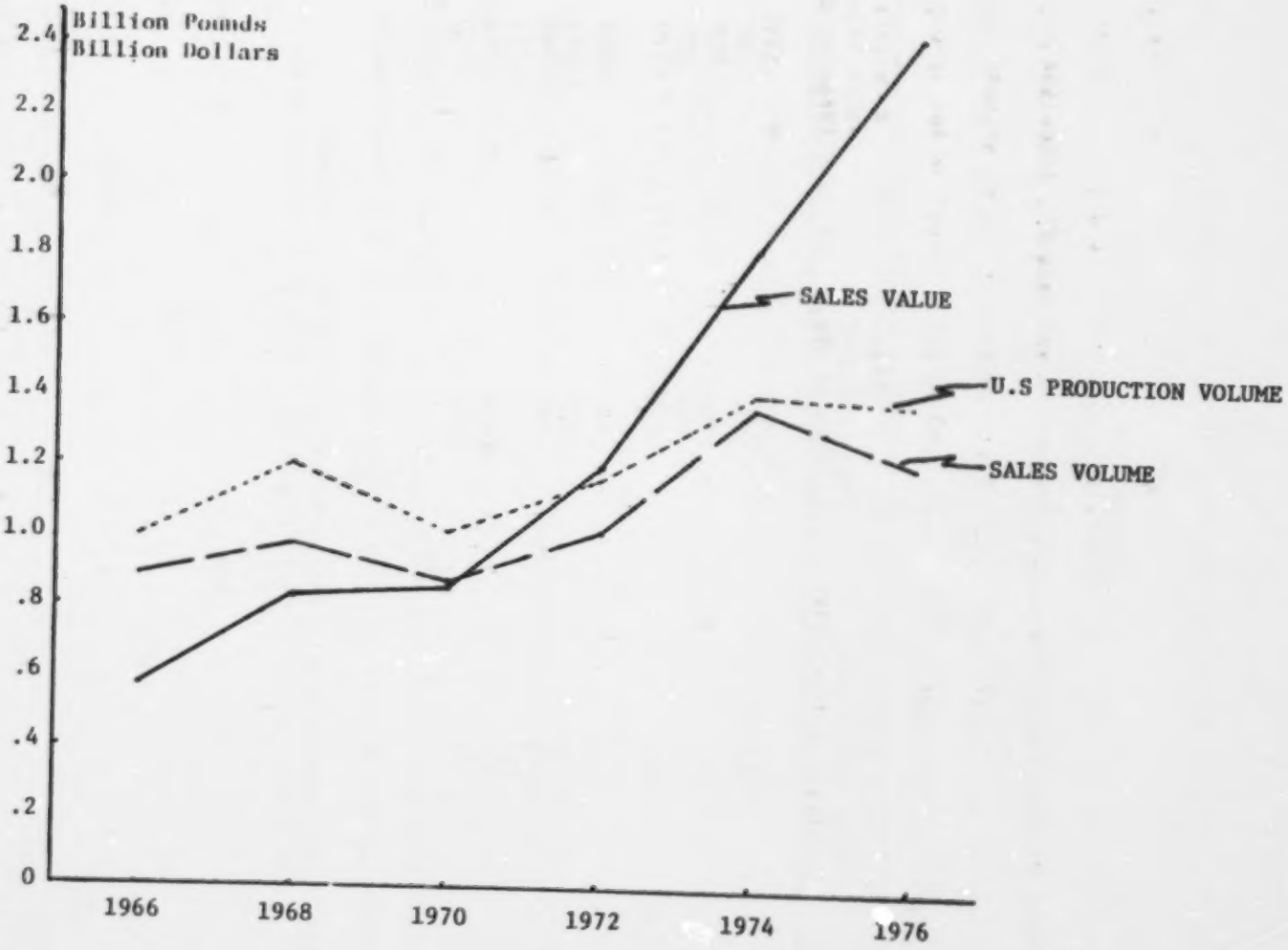
U.S. production of synthetic organic pesticides has increased markedly during the past decade (see Figure 1 and Table 1). Industry growth has occurred quite steadily although there were peaks in production in 1968 and 1975. Pesticide production is expected to resume its upward growth with long term forecasts at 6-8% per year (Farm Chemicals, Feb. 1977). The U.S. pesticide producing industry is a growth industry based on the past record, and is expected to be in the future as well.

Sales

The long term trend of growth in the pesticide industry is reflected in sales value and volume as well as production. U.S. sales value of synthetic organic pesticides has increased annually without exception during the past decade (see Figure 1 and Table 1). Sales volume has increased quite steadily during the same time period. Sales volume has averaged about 1.2 billion pounds per year since 1970, about 300 million pounds higher than during preceeding years. The pesticide industry is a dynamic one, adjusting to market demand for pesticides which varies considerably from year-to-year depending upon such factors as crop plantings, weather, pest infestations, and crop prices. For example, according to Robert Ouellete and John King, 1975 sales of pesticides were off primarily because cotton acreage declined about 30 percent, corn acreage did not increase, and wheat and soybean acreage increased only minimally from 1974 to 1975 (Ouellette and King, 1976). In addition, pesticide prices increased sharply and 1975 was a dry year in the

FIGURE 1

U.S. Pesticide Production, Sales Volume[1/] and Sales Value, 1966-1976



[1/] U.S. and Export; synthetic organic pesticides only.

SOURCE: International Trade Commission, "Synthetic Organic Chemicals, United States Production and Sales."

Table 1

Synthetic Organic Pesticides: U.S. Production and Sales[1/], 1966-1976

Year	Production Volume (billions of lbs)	Sales Quantity (billions of lbs)	Sales Value (billions of dollars)
1966	1.013	.882	.584
1967	1.050	.897	.787
1968	1.192	.960	.849
1969	1.104	.929	.851
1970	1.034	.881	.870
1971	1.136	.946	.979
1972	1.158	1.022	1.092
1973	1.289	1.199	1.344
1974	1.417	1.365	1.815
1975	1.603	1.328	2.366
1976	1.364	1.193	2.410

1/ Domestic and export; includes a small quantity of soil conditioners.

Source: U.S. International Trade Commission, "Synthetic Organic Chemicals, United States Production and Sales," various years

major agricultural regions of the U.S., thus reducing pest problems and, consequently, pesticide usage. In 1976, sales volume of pesticides was down slightly as the very dry conditions continued (CRB/USDA, 1977).

USDA pesticide market studies covering the years 1974 through 1977 indicate that pesticide supplies have generally grown in relation to needs for agricultural use of pesticides (which accounts for about two-thirds of the United States pesticide usage) (ERS/USDA, July 1975, April 1976, and February 1977).

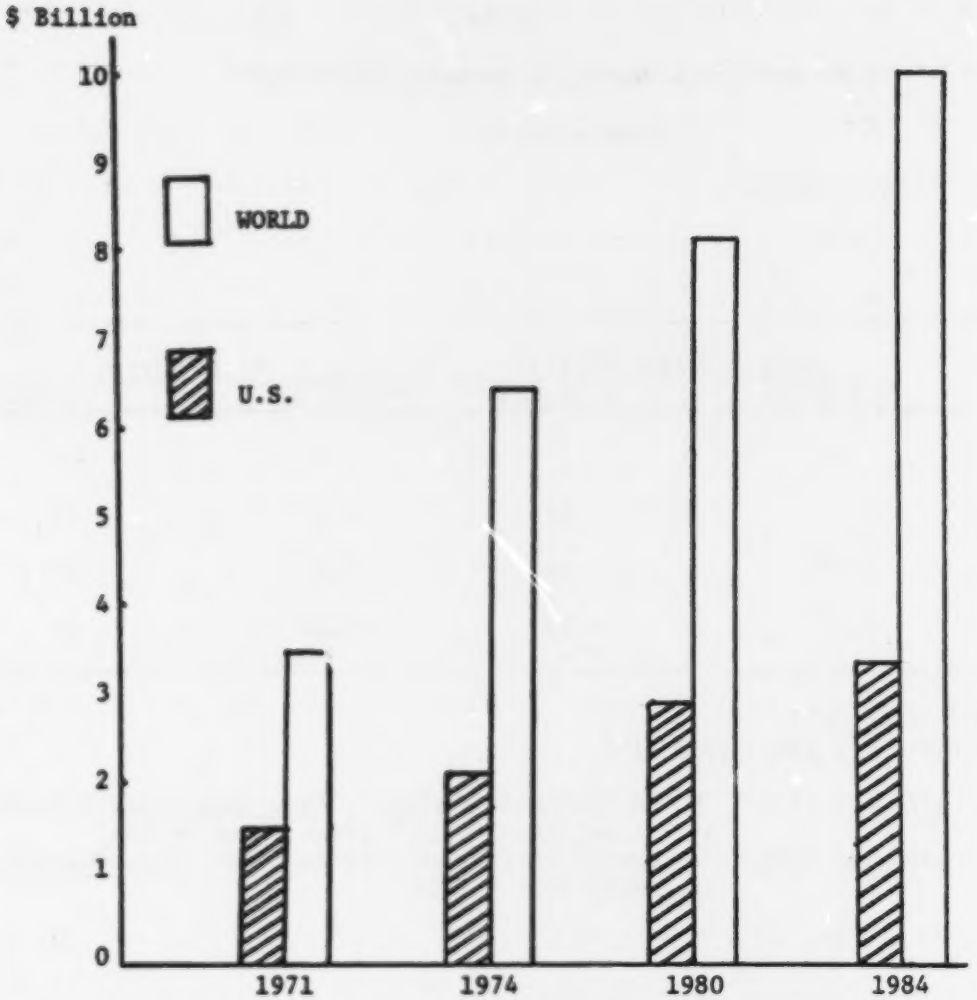
U.S. AND WORLD PESTICIDE MARKETS

The world market for pesticides is growing, as is the U.S. market, but at a faster rate according to available information. Farm Chemicals predicts U.S. pesticide sales of 2.7 billion dollars in 1980 and 3.3 billion dollars in 1984, an increase of 19% during the five-year period (see Figure 2 and Table 2) (Farm Chemicals, Sept. 1977). During the same time period, the publication predicts a 24 percent increase in world sales, from 8.1 billion dollars in 1980 to 10.0 billion dollars in 1984 (see Figure 2 and Table 2). These rates of growth have slowed somewhat from earlier in the 1970's, but are still substantial. They reflect the maturing of the pesticides market, especially in the U.S. and other developed countries where most acreage and livestock which would benefit from pesticide application have already come under treatment. They also reflect the fact that the base upon which the rate of growth is calculated has become considerably larger. For example, the projected two billion dollar increase from 1980 to 1984 in the world pesticide market would represent more than a 55 percent increase over the 1971 base of 3.6 billion dollars.

The fastest growing market is in Africa, with sales projected to increase by 182 percent between 1980 and 1984 (see Table 3). Other fast growing markets are Central and South America (32 percent), Asia and the Far East (28 percent), and the Middle East (26 percent).

FIGURE 2

U.S. and World Pesticide Markets, 1971-1984[1/]
User's Level (1977 Price Level)



1/ 1980 and 1984 estimated in source article

SOURCE: "World Pesticide Markets," Farm Chemicals, September 1975;
"A Look at World Pesticide Markets," Farm Chemicals, September 1977.

Table 2

U.S. and World Pesticide Markets, 1971-1984[1/]

User's Level

Year	United States Market		World Market	
	$ billion	% Change	$ billion	% Change
1971	1.4	--	3.6	--
1974	2.1	49	6.3	77
1980	2.7[2/]	28	8.1[2/]	27
1984	3.3[2/]	19	10.0[2/]	24

1/ 1977 price level
2/ Estimated by Farm Chemicals.

Source: 1971 and 1974: "World Pesticide Markets", Farm Chemicals, September 1975, p. 45; adjusted to 1977 price level by EPA.
1980 and 1984: "A Look at World Pesticide Markets," Farm Chemicals, September 1977, p. 38.

Table 3

World Pesticide Market Growth, 1974-1984

User's Level

Area	$ Million 1974	1980	1984	Projected Increase from 1980-1984 (%)
Western Europe & British Isles	1301	1728	1946	13
Eastern Europe Including USSR	527	815	921	13
Middle East (Egypt, Syria, Greece, Turkey, Israel, Lebanon, Sudan)	150	305	386	26
Africa	92	210	593	182
Asia (Iran, Pakistan, Afghanistan, India)	157	244	313	28
Far East including People's Republic of China	480	969	1245	28
Australasia	96	145	174	20
Central & South America	410	825	1092	32
North America	1977	2812	3291	17
TOTAL	5138	8053	9961	24

Source: "A Look at World Pesticide Markets," Farm Chemicals, September 1977, p. 42.

Quotations about the Future of the U.S. and World Pesticide Markets

The following two pages contain quotations about the future of the U.S. and world pesticide markets from trade publications and government reports. These quotations indicate that growth is projected for both the U.S. and world pesticide markets.

According to experts in industry and government, the world pesticide market is expected to grow faster than the U.S. market. There are still many parts of the world, most notably Africa, where pesticides are used on only a small proportion of acreage and livestock.

The expanding market for pesticides at the U.S. and world levels favors a healthy and growing industry, both in the U.S. and abroad. Foreign-based U.S. pesticide producers will benefit, as well as U.S.-based producer/exporters. An expanding market is much more favorable for meeting increasing R&D costs and environmental safety requirements than would be the case in a stable or declining industry.

Quotations about the Future of the U.S. Pesticide Market

Source	Remarks
Ouelette & King, Chemical Week, June 23, 1976, p. 29	"Increases in the domestic use of pesticides are not likely to match those of past years because a high percentage of crop acreage is already being treated and there is not enough untreated acreage left to sustain earlier growth rates. In addition, pest control costs will continue to climb, partly as a result of pesticide price increases caused by the rising costs of development, registration and production."
Farm Chemicals, Feb. 1977, p. 22	"In his luncheon talk about the future of the pesticide industry, Gordon L. Berg, editor of Farm Chemicals, pointed to the large investments by foreign companies in the domestic market and several new U.S. products recently introduced." (See "Pesticide Roundup", Farm Chemicals, Jan. 1977, pp. 39-66 for discussion of new products and new label clearances in 1977 for 47 companies.) " 'The action in the U.S. Market alone is fantastic,' he said." "U.S. consumption of pesticides has been increasing at the rate of 9% per year. There's no question that pesticides have emerged as a large, sophisticated chemical industry."
Agricultural Outlook, Oct. 1977, p. 9	"Pesticide supplies should again be ample for the 1978 season." "Demand for herbicides, which has been increasing rapidly in the last 15 or 20 years, is expected to level off as most major crop markets are saturated. Changes in future demand will be largely a function of acres grown."
Agriclutural Outlook, Dec. 1977, p. 10	"Rapid addition to capacity over the past several years should permit ample production of nearly all types of pesticide materials in 1978." "Demand . . . is expected to ease next year, largely because of set-aside programs. In particular, the set-aside program for feed grains could reduce the demand for herbicides."
ERS/USDA, Evaluation of Pesticide Supplies and Demand for 1977, AER No. 366, Feb. 1977, p. vi	"USDA projections for the United States for 1974 through 1985 indicate little change in insecticide and fungicide use and an annual increase of 5 to 6 percent in herbicide use. These projections assume greater use of reduced-tillage and pest-management practices, increased pest resistance, and greater use of pesticide combinations, particularly for herbicides."
Farm Chemicals, Feb. 1977, p. 22	The consensus of attendees to the Pesticide Industry Seminar on January 13, 1977, in New York City was summed up as follows: "In spite of the problem of meeting new testing requirements for pesticides in current use and increased R&D costs for development of new chemicals, the U.S. pesticide market will continue to grow in the future." Aris P. Christodoulu, Vice President of Blyth Eastman Dillon brokerage firm, "forecast a long-term growth [in the pesticide industry] of 6-8% per year . . . . "
Ouellette & King, Chemical Week, June 23, 1976, p. 28	"The improved outlook should also be reflected in plant construction. Last year 49 plants were under construction or being expanded."
Farm Chemicals, Jan. 1977, p. 50	"During the past year, Fisons U.K. has undertaken several significant programs designed to enhance the company's stature in the agrochemical field, both in the U.S. and abroad. In late 1975, Fisons announced the purchase of a 435-acre site in Muskegon, MI, where it is now engaged in its first phase of a multimillion dollar manufacturing developmental building program. The initial phase involves the construction of a $6.5 million plant for the production of Ficam W . . . ." "Additional manufacturing plants scheduled to be built on the Muskegon site include a site for formulation of Nortron, a sugar beet herbicide." "As part of its U.S. buildup, Fisons has also purchased a 300-acre farm in the lower Rio Grande Valley in Texas. The farm will be used for testing of potential agricultural chemicals produced by Fisons research and development facility in the United Kingdom. Development work directed at the U.S. market will also be undertaken."
ERS/USDA, Evaluation of Pesticide Supplies and Demand for 1974, 1975, and 1976, AER No. 300, July 1975, p. vi	"Substantial expansion of production capacity is currently planned or underway. Twenty-one of 29 firms have reported they were expanding or planning capacity expansions of production facilities . . . ."
ERS/USDA, Evaluation of Pesticide Supplies and Demand for 1976, AER No. 332, p. 13	"Increases in pesticide use similar to those in the last 10 years are not likely. Pest control costs are expected to continue to rise, but more gradually. The high percentage of crop acreage treated implies that there is not enough untreated acreage left to sustain earlier growth rates. However, some growth is anticipated as new products are introduced to supplement existing products or to provide pest control not now being achieved."

Quotations about the Future of the World Pesticide Markets

Source	Remarks
Farm Chemicals, Sept. 1977, p. 38	"The [pesticide] industry's leading international marketers . . . peg the world market at $8 billion by 1980, climbing to $9.9 billion by 1984, a projected growth of 24% over the five years." "The companies participating . . . predict greatest growth in sales will come in Africa, followed by Central and South America and the Middle East." "They see registration requirements and government controls on pesticide use in both developed and developing countries as the most limiting factor, followed by rising research and development costs, and inadequate exchange financing or credit." "The projections given here . . . leave little question that pesticides will continue to be a growth industry."
Stanford Research Institute, New Innovative Pesticides: An Evaluation of Incentives and Disincentives for Commercial Development by Industry, prepared for OPP, EPA, May 1977, p. 1	"Over the next ten years the flow of products from the chemical industry for [pest control] uses will continue, although there may be temporary shortages of some chemicals in certain functional or regional markets . . . . It is also possible that a serious constriction in the supply of selected existing efficacious products will result from EPA cancellations or restrictions. However, the chemical pesticide industry has been healthy and profitable, and many major companies in the United States and abroad are maintaining or increasing their investments in R&D and new plants, and are expected to continue their efforts to commercially develop new chemical pesticides that are commensurate with stabilized environmental guidelines."
Chemistry in the Economy, American Chemical Society, 1973, p. 241	"The world market for pesticides is still expanding profitably but is growing steadily more competitive."
Farm Chemicals, Feb. 1977, p. 22	Richard Lindstadt, Director of Market Research for Elanco Products Co., said, "The general level of world agriculture is on an upward trend with a growing sophistication of pesticide activity abroad. At the moment we can outproduce the demand for herbicides, but we will need additional capacity over the coming years."
Goring, "Prospects, Problems for the Pesticide Manufacturer", Farm Chemicals, Jan. 1976	"The use of pesticides should increase more than the three-fold growth projected for [world] food production." "The United States, Japan, and Western Europe spend considerably more per acre for pesticides than the rest of the world. Expenditures in other countries for pesticides are therefore expected to increase at a greater rate than increases in agricultural productivity. Existing trends in sales suggest a two-fold increase by the mid-1980's and as much as a five-fold growth within two to three decades."
ERS/USDA, Evaluation of Pesticide Supplies and Demand for 1977, AER No. 366, Feb. 1977, pp. 10-11	"Although the pesticide growth rate for the next several years in the developing nations is projected at twice that for the developed nations, the latter are still expected to account for over 70 percent of world pesticide use by 1980."
	"Often insects and plant diseases [in developing nations] almost completely destroy many of their crops. For example, one disease (black pod) was reported to have destroyed up to 90 percent of Nigeria's cocoa crop. Further, 40 percent of Asia's rice crop and an estimated third of Latin America's total crop potential is lost to insects, diseases and weeds each year. Thus, in most of the developing nations, the benefits of increased pesticide use will probably exceed the risks for some time to come."
	"The developing nations rely mostly on the developed nations for their pesticides. FAO estimates indicated that slightly over half of the pesticides used in the developing nations were imported in the early seventies. This share was expected to increase to about 60 percent by the late seventies because of greater use of more complex pesticide chemicals."

TRENDS IN PROFITS AND SALES OF FIRMS MANUFACTURING PESTICIDES

Profits in the chemical industry specifically relating to pesticide operations are not well reported because most major firms do not report profits separately for their pesticides operations. Profits are high due to "strong patent protection, competition based on price with heavy emphasis on R&D, significant barriers to new entrants, concentration of sales among a few dominant manufacturers and market segmentation into many submarkets", according to one study specifically on the pesticide industry (Wm. Blair and Company Report, July 7, 1975). This study characterized the industry as one with "extraordinary profitability", in which "the most important determinant of marketing success is the R&D capability of a firm". Price elasticity of demand was found to be inelastic, which means that prices can be raised without equally proportional reductions in sales, (e.g., generally speaking, a price increase would increase profits).

Presented in this section is an analysis of recent data on profits and sales of pesticide firms. The primary data are those presented in the annual Fortune 500 Series (1972-76) and recent data published by Forbes magazine.

Sales and Profit Ranks

Review of sales and profit data reported in the Fortune 500 Series indicates that: (1.) pesticide firms rank in the top one-third of the 500 firms covered in the series, on an average-rank basis; and (2.) the rankings have remained quite stable since 1972.

In 1972, when FEPCA became law, 39 manufacturers of pesticides were included in the list of the 500 largest manufacturing firms in the U.S. published by Fortune magazine (see Table 4) (Fortune, May 1973). By 1976,

Table 4

Sales and Profit Ranks of Pesticide Manufacturers[1/] in
Fortune Top 500 Industrials, 1972 and 1976

Company	Industrial Class[2/]	Sales Rank		Profit Rank	
		1972	1976	1972	1976
Mobil	Petroleum Refining	7	5	6	5
Gulf Oil	Petroleum Refining	11	7	24	10
Shell Oil	Petroleum Refining	17	13	15	11
E.I. DuPont	Chemicals	16	16	11	17
Tenneco	Petroleum Refining	26	20	22	23
Union Carbide	Chemicals	27	21	21	18
Phillips Petroleum	Petroleum Refining	36	24	35	20
Dow Chemical	Chemicals	41	25	28	13
Monsanto	Chemicals	46	42	46	25
Ashland Oil	Petroleum Refining	70	43	87	74
3M	Scientific Equipment	51	53	17	29
CPC International	Food	82	79	59	86
Allied Chemical	Chemicals	89	82	93	95
Warner Lambert	Pharmaceuticals	92	93	45	57
Uniroyal	Rubber Products	69	95	135	369
FMC	Industrial Equipment	91	97	129	141
PPG	Chemicals	104	100	64	64
American Cyanamid	Chemicals	106	107	52	75
Kerr-McGee	Petroleum Refining	202	114	122	79
Pfizer	Pharmaceuticals	130	118	53	56
Merck & Co.	Pharmaceuticals	147	132	36	36
Hercules	Chemicals	153	142	81	102
Olin	Chemicals	114	164	488	156
Diamond Shamrock	Chemicals	219	167	183	71
Eli Lilly	Pharmaceuticals	172	171	41	44
International Minerals & Chemicals	Chemicals	265	181	249	77

Table 4 (cont.)

Sales and Profit Ranks of Pesticide Manufacturers[1] in Fortune Top 500 Industrials, 1972 and 1976

Company	Industrial Class[2]	Sales Rank		Profit Rank	
		1972	1976	1972	1976
Martin Marietta	Aerospace	134	189	116	143
Rohm & Haas	Chemicals	218	195	138	486
Stauffer	Chemicals	247	204	182	97
Abbot Laboratories	Pharmaceuticals	251	209	159	123
GAF	Scientific Equipment	181	216	204	377
Universal Oil Prdt.	Petroleum Products	269	-	342	-
Upjohn	Pharmaceuticals	258	220	137	144
Pennwalt	Chemicals	286	272	303	280
Morton-Norwich	Chemicals	324	318	222	484
Reichhold Chemical	Chemicals	480	325	402	401
Witco Chemical	Chemicals	390	336	353	345
Kewanee Industries[1]	Chemicals	-	411	-	278
Vulcan Materials	Mining	425	427	287	270
Nalco Chemical	Chemicals	-	447	-	240
Ferro	Chemicals	497	451	344	373
	NUMBER OF FIRMS	39	40		

1/ Pesticide Manufacturers are those which either appear, or that have subsidiaries that appear in the 1976 International Trade Commission report, Pesticides and Related Products.

2/ As indicated by Fortune, that area which represents the greatest value of industrial sales.

Source: Fortune, "The 500 Largest Industrial Corporations," May 1973.
Fortune, "Fortune's Directory of the 500 Largest U.S. Industrial Corporations," May 1977.

the number of pesticide manufacturers included on the list had increased by one, to forty.

The average sales rank of these firms was 163 in 1972 and a slightly higher 154 in 1976 (see Table 5). The average rank by profit was somewhat lower (137 in 1972 and 145 in 1976) (see Table 5).

Based on sales, 30 of the 39 pesticide firms increased their rank in the Fortune 500 list between 1972 and 1976, while eight ranked lower and one firm maintained the same rank (see Table 5).

Rankings remained about the same on the basis of profits. Twenty firms were ranked higher in 1976, 19 firms were ranked lower, and two firms remained at the same rank (see Table 5).

According to these data, almost 10 percent of the 500 largest manufacturing firms in the U.S. produce pesticides and this percentage has not changed since the implementation of FEPCA in 1972.

Leading pesticide manufacturers are among the largest industrial corporations in the U.S., and generally have fared well compared with other corporations on basis of sales and profits since 1972. Also, there is the following tendancy: the larger the firm, the better the record, e.g., none of the top 10 in sales in 1972 had a decline in sales rank between 1972 and 1976 (eight of them had increasing rank on basis of profits).

Table 5

Changes in Sales and Profit Ranks of Pesticide Manufacturers
Appearing in Fortune
List of 500 Largest U.S. Manufacturers, 1972-1976

		Sales	Profit
No. pesticide firms changing rank from 1972 to 1976		40	39
Pesticide firms ranked higher in 1976:	No.	30	20
	%	75	51
Pesticide firms ranked lower in 1976:	No.	10	19
	%	25	49
No. pesticide firms ranked same in 1976		1	2
Average rank - 1972		163	137
- 1976		154	145

SOURCE: EPA calculations based on data from Fortune, May 1973 and May 1977.

Profitability

Most of the large firms producing pesticides are multi-product firms. When categorized by the product line which produces the largest volume of sales, 49 percent of the pesticide producers on Fortune's list are classed in the chemical industry, 20 percent in the petroleum refining industry, 15 percent in the pharmaceutical industry, and 17 percent distributed about evenly among the scientific equipment, aerospace, food, rubber products, industrial equipment, and mining industries (see Table 4 for classification of firms).

It is likely that the profitability of pesticide manufacturing is slightly higher than for chemical manufacturing in general. Averaged over the last five years, the pesticide manufacturers on the Fortune 500 list had an average return on equity of 16.2 percent (see Table 6), compared to 15.6 percent for the chemical industry (see Table 7).

These rates of return compared quite favorably to 30 other industries which were ranked by Forbes magazine (Forbes, "Who's Where . . . ", 1978). With its 15.6 percent rate of return, the chemical industry ranked sixth highest, well above the 30-industry median of 12.9 percent and fairly near the highest rate of return of 18.8 percent (see Table 7).

The profitability figures for return on capital, rather than on equity, are all lower. The chemical industry was ranked tenth by this criterion, with a return on capital of 10.8 percent (see Table 7). The pesticide firms achieved the slightly higher rate of return on capital of 12.2 percent (see Table 6).

Table 6

Most Recent 5-Year Average Profitability and Sales Growth of Pesticide Manufacturers in Fortune Top 500 Industrials, 1976

Company	Profitability		Sales Growth (%)
	Return on Equity (%)	Return on Total Capital (%)	
Mobil	14.6	12.0	22.7
Gulf Oil	14.0	11.5	19.7
Shell Oil	15.7	11.9	16.7
E.I. DuPont	12.8	10.7	11.8
Tenneco	17.5	8.7	16.5
Union Carbide	16.7	12.0	13.5
Phillips Petroleum	16.5	12.4	16.9
Dow Chemical	27.2	16.5	20.3
Monsanto	18.3	13.4	13.2
Ashland Oil	20.3	11.6	19.1
3M	19.0	16.8	13.1
CPC International	17.4	13.7	13.3
Allied Chemical	12.9	8.9	11.8
Warner Lambert	16.1	13.7	13.5
Uniroyal	6.2	4.7	7.4
FMC	12.9	9.4	8.5
PPG	13.2	9.8	10.7
American Cyanamid	14.1	11.3	10.1
Kerr-McGee	16.6	13.4	24.3
Pfizer	17.4	13.5	13.5
Merck & Co.	28.1	25.9	14.2
Hercules	12.4	10.2	12.9
Olin	11.3	9.5	10.7
Diamond Shamrock	24.9	14.2	14.7
Eli Lilly	22.3	21.5	14.2
International Minerals & Chemicals	28.4	16.8	16.0
Martin Marietta	13.0	8.7	5.4
Rohm & Haas	6.7	6.4	15.5
Stauffer	20.6	14.6	13.7
Abbot Laboratories	18.6	13.8	16.0
GAF	4.6	4.0	8.3
Universal Oil Prdt.	7.2	5.1	8.7
Upjohn	18.5	15.4	16.8
Pennwalt	12.3	9.1	10.7

Table 6 (cont.)

Most Recent 5-Year Average Profitability and Sales Growth of Pesticide Manufacturers in Fortune Top 500 Industrials in 1976

Company	Profitability		Sales Growth (%)
	Return on Equity (%)	Return on Total Capital (%)	
Morton-Norwich	8.5	6.8	10.3
Reichhold Chemical	14.5	10.5	21.1
Witco Chemical	16.1	10.1	16.2
Kewanee Industries[1/]	--	--	--
Vulcan Materials	19.9	14.1	11.9
Nalco Chemical	24.7	23.7	14.2
Ferro	15.5	13.5	16.2
Range			
High	28.4	25.9	24.3
Low	4.6	4.0	5.4
Median	16.1	12.0	13.7
Mean	16.2	12.2	13.6

1/ Profitability and sales growth not available in Forbes.

Source: Companies selected from Fortune, May 1977.
Profitability and Sales Growth from Forbes, January 9, 1978.
Ranges, Medians and Means calculated by EPA.

Table 7

How the Chemical Industry Compares to Other Industries on Profitability and Growth, 1973-Present

	Profitability				Growth			
	Return on Equity		Return on Capital		Sales		Earnings/Share	
	5-yr ave.[1] (%)	Rank	5-yr. ave. (%)	Rank	5-yr. ave. (%)	Rank	5-yr. ave. (%)	Rank
Chemical	15.6	6	10.8	10	13.6	8	18.0	3
30-Industry Median	12.9	--	9.7	--	12.4	--	10.1	--
Highest Industry	18.8	1	14.0	1	22.5	1	25.4	1
Lowest Industry	7.9	30	4.3	30	6.6	30	2.8	30

1/ 1973 through 1976 plus 12-month period ending with most recent quarterly report.

Source: "Who's Where in the Industry Groups," Forbes, January 9, 1978, pp. 170-176.

Sales Growth

Forbes magazine also provides information about five-year average growth in sales (Forbes, "Who's Where . . . ", 1978). Both the pesticide firms listed by Fortune (Table 6) and the chemical industry (Table 7) grew in sales by an average of 13.6 percent per year during the past five years. This performance ranked the chemical industry eighth of 30 industries, slightly above the 30-industry median sales growth rate of 12.4 percent (see Table 7).

Quotations Relevant to Pesticide Industry
Maturity, Prices and Profitability

Quotations about the maturing of the pesticide industry and its effect on prices and profitability are contained on the following page.

In summary, the major markets for pesticides in the U.S. have been identified, products developed and demands reasonably well satisfied. In the future, growth will depend more upon expansion of existing markets than upon development of new markets, e.g., spectacular growth of pre-emergence herbicides market during 1970's. However, as discussed above, the outlook for the pesticide industry is one of growth in sales and favorable prospects for profitable operations compared to other industries.

Quotations Relevant to Pesticide Industry Maturity, Prices and Profitability

Source	Remarks
Seehusen, "The Economic Health of the Pesticide Industry", Jan. 1978	"The [pesticide] market is also maturing. There are a number of products available for each crop; nearly all the major needs have been satisfied reasonably well. The probability of a basic manufacturer discovering a lower cost and/or more effective products appears to be rather small."
Farm Chemicals, Feb. 1977, p. 22	"Aris P. Christodoulu, vice-president of Blyth Eastman Dillon brokerage firm, presented a picture of significant earnings on a per-share basis from agricultural chemicals vs. other chemical business among leading companies.".
Forbes, Jan. 1, 1970, p. 90	In discussing the declining profits in the fertilizer industry back in the late 1960's, J. Peter Grace stated, "As a result of the long-term and consistant growth in demand for fertilizer materials, averaging 8.6% per year for the last decade, new investment was attracted in unprecendented amounts, producing capacity far in excess of any current demand. The result was a severe price deterioration in 1968." "IMC plunged $21 million into the red, and Grace suffered a decline in fertilizer profits of nearly 70%."
Nobel, ed., Kline Guide to the Chemical Industry, 197-, p. 142-3	"Prices and profits are quite variable in pesticides depending upon the proprietary positions obtained by the producers." "Prices of [those patented pesticides which don't have competition from other products] can be maintained along with reasonably good profits." "Many of the older products, however, . . . do not have the protection of patents and have degenerated to the state of commodities." "Competition between similar products thus forces prices and profits down."
Forbes, Jan. 9, 1978, p. 191	"Like people, companies often burst into prominence in their youth, show signs of maturity, then lapse into decline and decay."
Forbes, Jan. 1, 1970, p. 90	In discussing the maturing of the chemical industry, the following statement was written, "Thus, though chemical sales continue to grow very nearly as rapidly as ever, the industry no longer has anything like the profit potential it once had . . . ."
Forbes, Jan. 1, 1970, p. 91	"Traditionally, the industry's great strength has lain in its ability to produce a dizzying succession of new products, to move on into another new market just as its previous one begins to mature, to keep its growth trending uninterruptedly upwards. The industry's massive research outlays . . . have made such a record possible, but research has not come up with a major new product in some years, and there is at least a possibility that chemical research is nearing the point of diminishing returns." "Says Stauffer's, director of research, Donald Nestick, What we need is a big new innovation - something that will do for us what the transistor did with the vacuum tube. This does not mean that the industry's technical resources are exhausted, or that there is not a great deal of mileage to be gained from refining existing products . . . . But it probably does mean that - without such a discovery - the industry will be hard put to maintain the spectacular growth of the last two decades."

U.S. PESTICIDE INDUSTRY ENTRANCES AND EXITS

There has been no significant trend toward net entry or exit of firms in the pesticide industry since FIFRA was amended in 1972, based on firms reporting production and sales of pesticides and related products to the U.S. International Trade Commission. During the period 1972 through 1976, the number of entrances was twelve (12), compared with nine (9) exits (aside from five instances where firms both entered or exited or vice versa during this period) (see Table 8). A total of 96 firms reported during the five year period, giving average rates of entry and exit (turnover) of 2 to 3 percent per year, with little tendency for net change (see Appendix II).

The ITC report series, is thought to be quite representative of the industry. It accounts for 90 percent or more of U.S. production and sales of pesticides and related products. Most major basic pesticide producing firms report consistently to ITC, whereas minor producers and firms involved largely in formulation/marketing may report less consistently. Reporting by the latter groups may cause year-to-year variations in the number of firms reporting which are of little significance. The tabulation of firms reporting to ITC is considered by EPA to be indicative of trends in the pesticide producing industry, although data on individual firms may not be a clear indication of "entry" or "exit" during a given year.

Another way of looking at entries to the pesticides industry is the number of firms becoming newly registered as pesticide manufacturers. According to EPA Registration Division records, 1,879 firms were first registered as pesticide manufacturers between 1972 and 1977 (see Table 9). This is an average of over 300 firms per year.

Table 8

SUMMARY OF PESTICIDE AND RELATED INDUSTRY ENTRANCES AND EXITS SINCE 1972
BASED ON REPORTS OF INTERNATIONAL TRADE COMMISSION

ENTRANCES		EXITS	
Firm	Year	Firm	Year
Sandoz, Inc.	1973	Occidental Chemical Company	1973
Ashland Chemical Co. (Division Ashland Oil)	1973	Fisher Chemical Co., Inc.	1973
Niklor Chemical Company	1973	Valchem	1973
Interstab Chemical, Inc.	1974	Cincinnati Milacron Chemicals, Inc.	1974
Lakeway Chemicals, Inc.	1974	Gordon Corporation	1974
Nalco Chemical Company	1974	Shepard Chemical Company	1974
Greenwood Chemical Company	1975	Ventron Chemical Company	1974
Pelron Corporation	1975	FMC: (Industrial Chemicals Division only)	1975
Vinings Chemical Company	1975	Michigan Chemical Corporation	1976
Vicksburg Chemical Company	1975		
Kay-Fries Chemicals, Inc.	1976		
Parke-Davis + Company	1976		
TOTAL ENTRANCES = 12		TOTAL EXITS = 9	

NOTE: Does not count instances in which firms both entered and exited (or vice versa) list during period as was case with five firms (Sobin Chemicals; R.S.A. Corp.; Salsbury Laboratories; Martin-Marietta Corp.; Pfister Chemicals, Inc.)

SOURCE: U.S. International Trade Commission, U.S. Production and Sales of Pesticides and Related Products, for years 1972 through 1976

Table 9

Number of Firms Registering for the First Time With EPA As a Pesticide Manufacturer,[1/] 1972-1977

Year	Number of New Firms
1972	396
1973	413
1974	347
1975	199
1976-77	524
Total	1,879

1/ Includes basic manufacturers and formulators but not distributors.

Source: Registration Division, OPP, EPA, January 1978

In examining exits from the pesticide industry, EPA staff made a survey of the firms filing for bankruptcy under Section X of the Securities and Exchange Act. From this source it was determined that none of the 173 firms reported in the SEC annual reports from 1972 to 1976 as having gone into bankruptcy, were pesticide firms. This finding indicates that firms in the pesticide business are either profitable or, when leaving this industry, can be sold to others at a price sufficient to cover all obligations.

The pesticide industry is planning plant expansions well in line with trends for industry growth discussed above. In 1975 and 1976, USDA surveyed the pesticide industry to collect data on plans for plant expansion, among other information. In 1975, 21 of 29 firms surveyed indicated that they were expanding capacity or planning to expand capacity in the next few years (ERS/USDA, July 1975). These 21 firms accounted for expansion programs at 49 separate pesticide plants.

Respondents to the 1976 surveys reported plans to expand pesticide plant capacity by 12 percent in 1976 and another 16 percent in 1977. The expansion activity focused on herbicide production with plans for expansion in herbicide production capacity of 19 percent for 1976 and 23 percent for 1977 (ERS/USDA, April 1976, February 1977).

PESTICIDE R&D EXPENDITURES

Magnitude of Pesticide R&D Expenditures

Reported pesticide R&D expenditures have increased from approximately 70 million dollars in 1970 to approximately 195 million dollars in 1976, according to National Agricultural Chemical Association reports (NACA, 1971, 1975, 1976) (see Table 10). These results are not statistical estimates based on a sample of firms, but they are believed by NACA to represent most of the pesticide industry's R&D expenditures in each year. They are thought to be a good indication of U.S. pesticide R&D expenditures.

Time trends are observed by converting these expenditures to a per-company basis for the period 1970 through 1976. During this period, R&D expenditures per company nearly trippled (from 2.1 million dollars in 1970 to 5.9 million dollars in 1976). If all expenditures are deflated to the 1970 price level, the increase in R&D expenditures is 68 percent. This considerably exceeds the trend of R&D expenditures in U.S. industry generally, which at a constant price level has remained level since 1970 (from 19.8 billion dollars in 1970 to 19.9 billion dollars in 1976) (NSF, 1976, 1978).

Comparison of R&D Expenditures and Sales

The magnitude and growth in pesticide R&D expenditures can be put in perspective by comparing them to pesticide sales during the same time period. For the period from 1970 to 1976, reported pesticide research and development expenditures of 857 million dollars equalled 7.6 percent of the 11,340 million dollars reported sales (see Table 10).

Table 10

Pesticide R&D Expenditures and Sales, 1970-1976

Year	Pesticide R&D Expenditures								Pesticide Sales				Total R&D As Percent of Total Sales 2/	Registration-Related R&D as Percent Of Total R&D 2/
	Total		Registration-Related 1/		Per Company 2/				Total		Per Company 2/			
					Total R&D		Registration-Related R&D							
	Current Price Levels	1970 Price Level	Current Price Levels	1970 Price Level	Current Price Levels	1970 Price Level	Current Price Levels	1970 Price Level	Current Price Levels	1970 Price Level	Current Price Levels	1970 Price Level		
	million dollars				thousand dollars				million dollars				percent	
1970	70	70	13	13	2,118	2,118	403	403	722	722	22	22	9.7	18.6
1971	88	85	18	17	2,436	2,361	497	482	1,044	1,012	29	28	8.4	20.5
1972	98	91	21	19	2,736	2,537	589	546	1,154	1,070	32	30	8.5	21.4
1973	111	91	26	21	3,075	2,518	714	585	1,417	1,161	39	32	7.8	23.4
1974	135	93	39	27	3,643	2,513	1,046	722	1,956	1,349	53	36	6.9	28.9
1975	160	101	45	28	4,338	2,739	1,214	766	2,471	1,560	67	42	6.5	28.1
1976	195	118	60	36	5,915	3,565	1,821	1,097	2,576	1,552	78	47	7.6	30.8
Total	857	649	222	161	--	--	--	--	11,340	8,426	--	--	7.6	25.9
Change, 1970-1976 2/	--	--	--	--	3,797	1,447	1,418	694	--	--	56	25	--	--
Percent 2/	--	--	--	--	179	68	352	172	--	--	254	114	--	--

1/ 1970 includes following R&D categories: Toxicology and metabolism, registration and others.
1971-1975 includes following R&D categories: Toxicology and metabolism, environmental testing, registration and others.
1976 includes following R&D categories: Toxicology, metabolism, environmental chemistry, residue analysis, registration, all other expenditures.

2/ EPA calculations.

Source: National Agricultural Chemicals Association, "Industry Profile Study," 1971, 1975, 1976.

However, with the exception of 1976, this percentage followed a declining trend. On a yearly basis, R&D expenditures declined from 9.7 percent of sales in 1970 to 6.5 percent in 1975, and then increased slightly to 7.6 percent in 1976 (see Table 10 and Figure 3). This increase in 1976 can be explained by the combination of a relatively small increase in reported sales in 1976 with the largest increase in R&D expenditures of the 1970's. Overall, sales increased by 254 percent from 1970 to 1976, while R&D expenditures increased by 179 percent (see Table 10 and Figure 4).

In summary, despite the large increase in pesticide R&D expenditures from 1970 to 1976, there has been a trend for R&D to absorb less of the sales dollar. The industry has shown confidence in the future of the industry by increasing its investments in R&D, and has received some confirmation of that confidence by its receipt of even greater increases in sales.

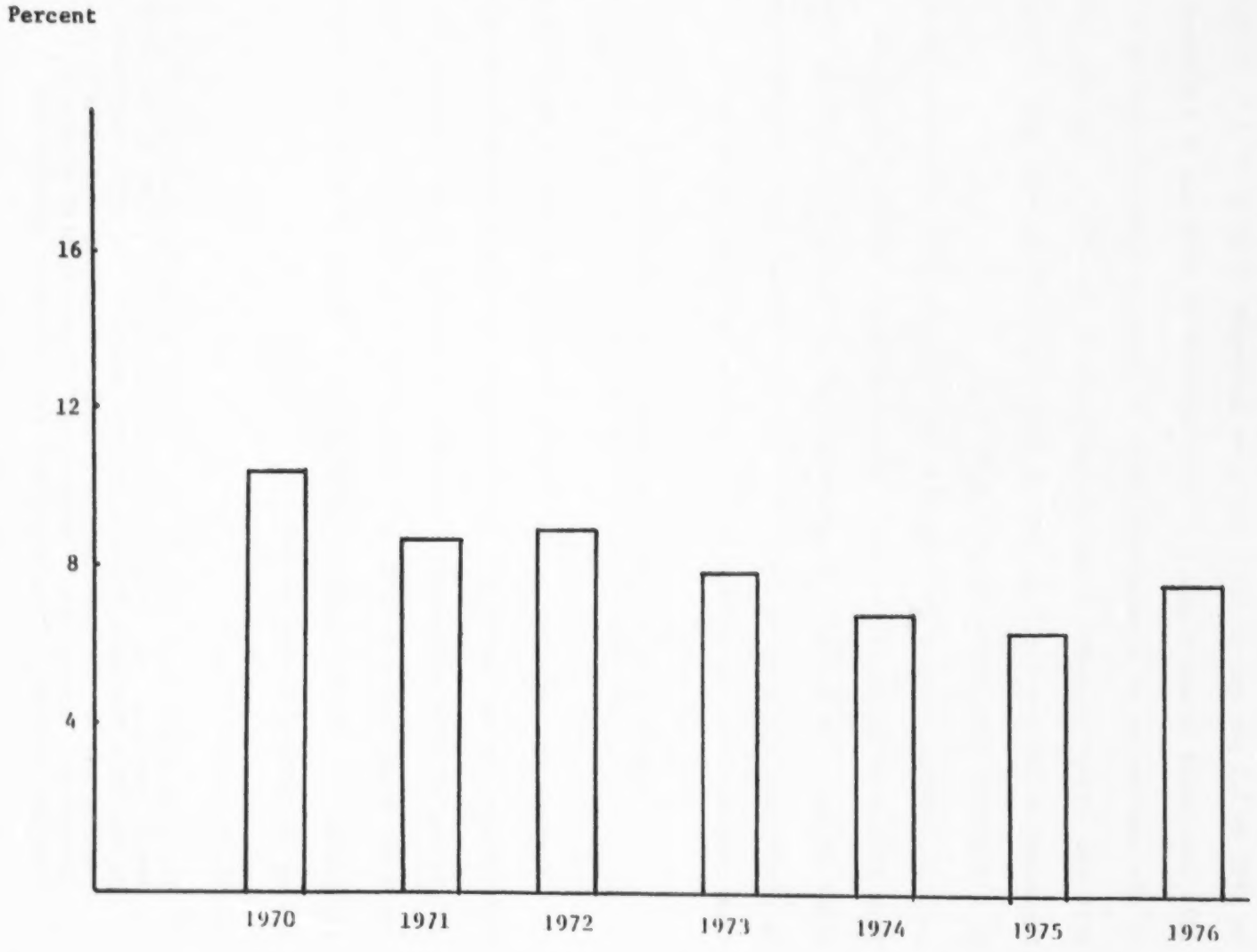
Comparison of Registration-Related R&D Expenditures and Total R&D Expenditures

Changes have occurred in the distribution of individual elements of R&D expenditures during the 1970's. Most notably, those R&D expenditures related to the registration process have increased from a low of 18.6 percent of total R&D expenditures in 1970 to a high of 30.8 percent in 1976 (see Table 10 and Figure 5). These elements[1/] averaged 25.9 percent of total R&D expenditures during the 1970-1976 time period.

1/ For most years these include the "toxicology and metabolism," "environmental testing," and "registration and other" categories of R&D reported in the NACA Pesticide Industry Profile Studies. In 1970, environmental testing was not included and in 1976 the categories were changed to the following: "toxicology," "metabolism," "environmental chemistry," "residue analysis," "registration," and "all other expenditures."

FIGURE 3

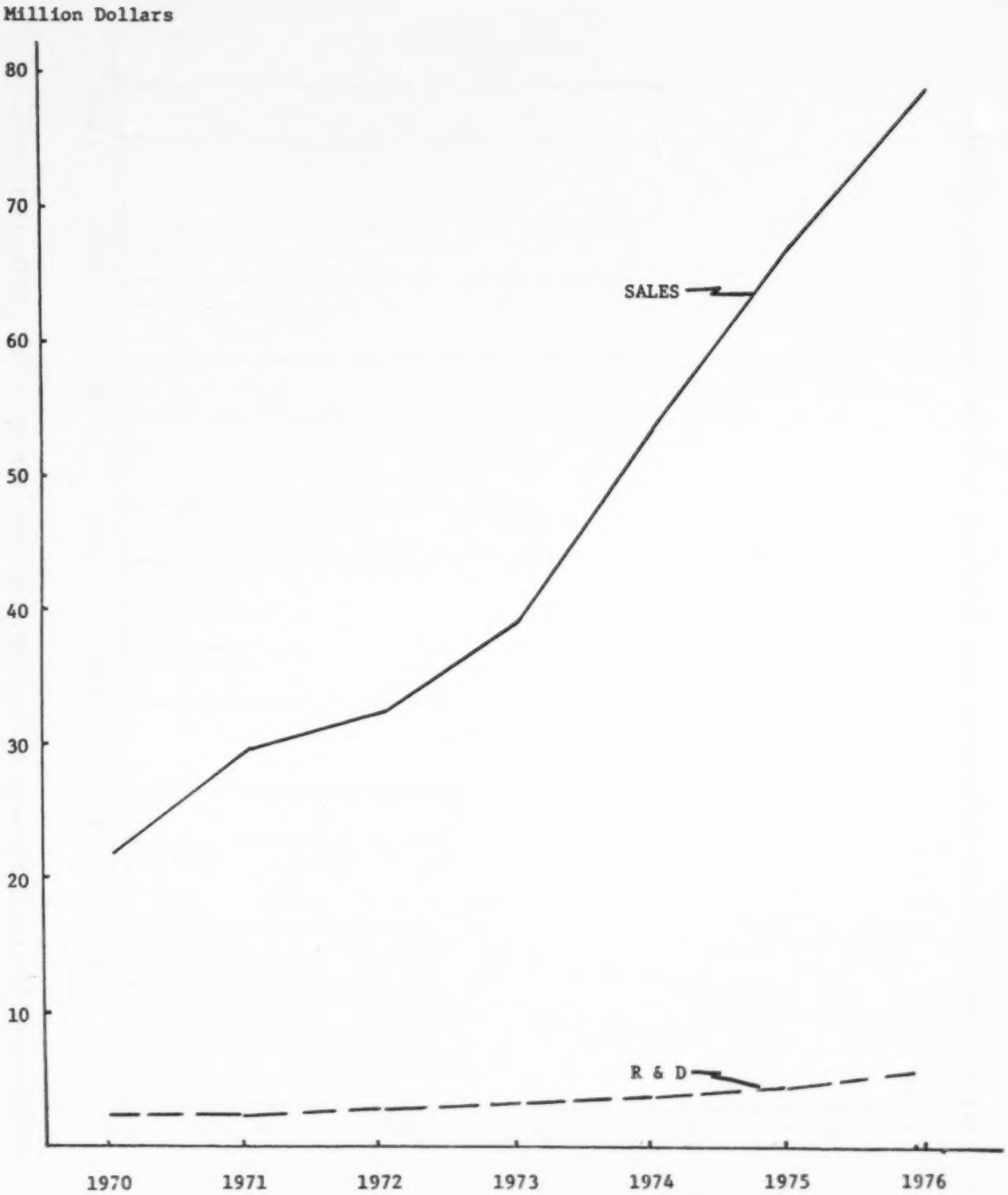
U.S. Pesticide R&D as Percent of Sales, 1970-1976



SOURCE: EPA calculations from data in: NACA, "Industry Profile Study", 1971, 1975, 1976.

FIGURE 4

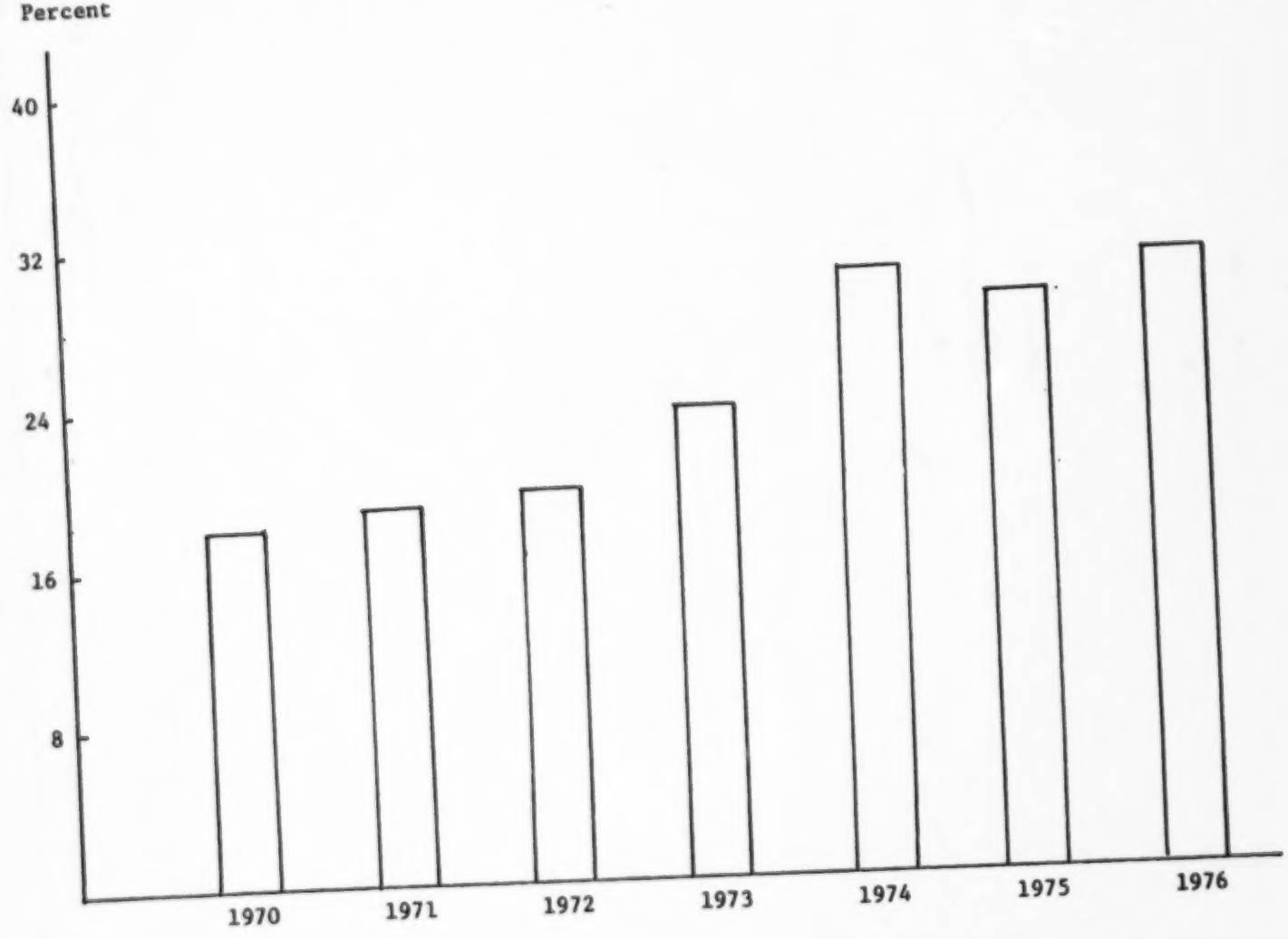
R&D Expenditures and Pesticide Sales per Company



SOURCE: EPA calculations from data in: NACA, "Industry Profile Study", 1971, 1975, 1976.

FIGURE 5

Registration-Related R&D Expenditures as a Percent of Total R&D Expenditures, 1970-1976



SOURCE: EPA calculations from data in: NACA, "Industry Profile Study", 1971, 1975, 1976.

Reflecting this shift in R&D expenditure patterns, registration-related R&D expenditures increased by 352 percent (from 403 thousand dollars per company in 1970 to 1,821 thousand dollars per company in 1976) during the same period that total R&D expenditures increased by 179 percent (from 2,118 thousand dollars per company in 1970 to 5,915 thousand dollars per company in 1976) (see Table 10 and Figure 6).

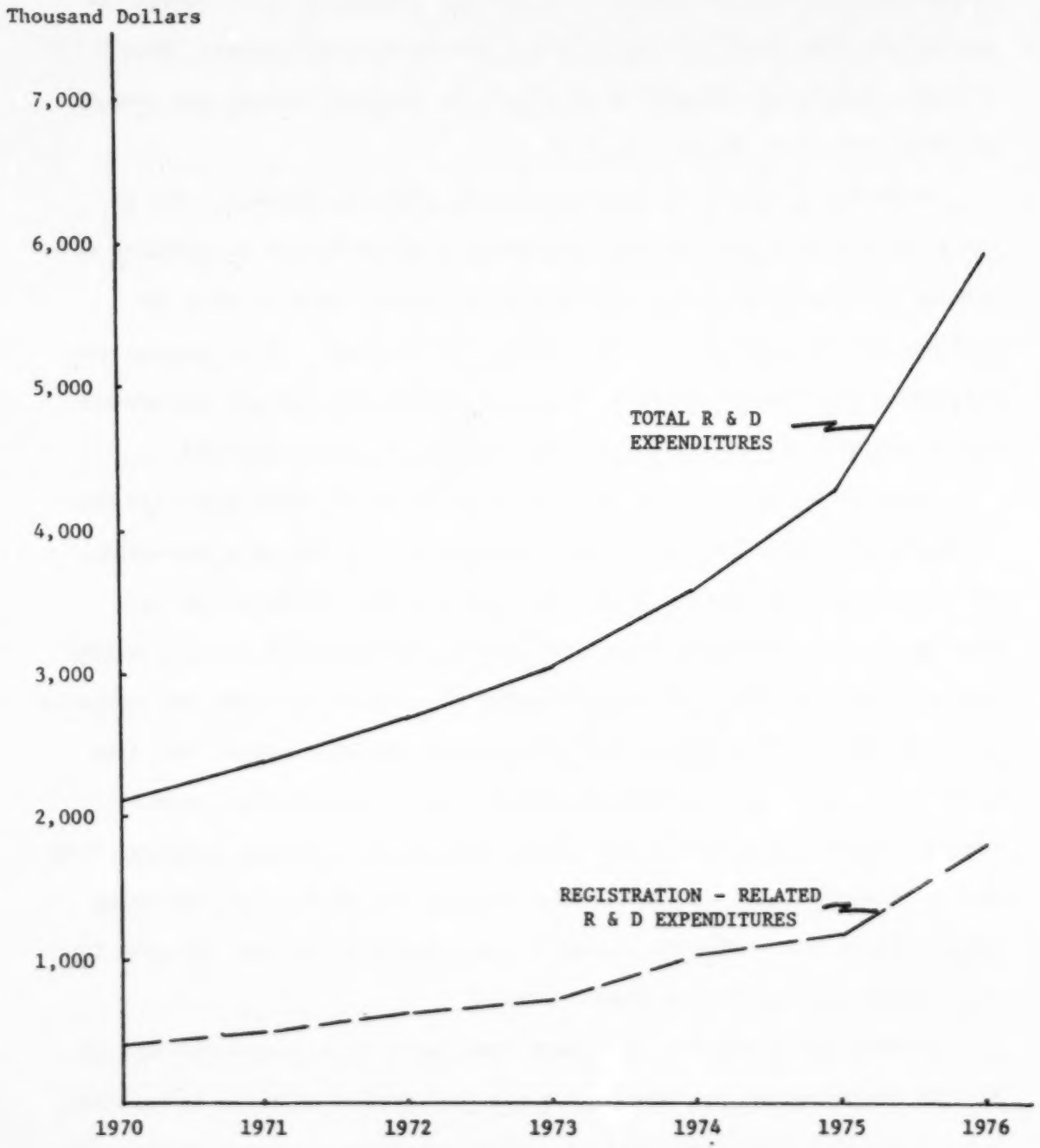
There are a variety of reasons for this shift in emphasis. One is the greater cost associated with developing a new pesticide as compared to finding a new use/market for an existing pesticide, combined with the time and effort involved in obtaining EPA registration. Other reasons are associated with changes internal to the pesticide industry and the greater risk associated with introducing a new chemical to the environment.

Internally, the industry has matured to the point where synthesis and screening activities have a smaller probability of producing a successful pesticide than they used to have. For example, NACA reported that an average of 5,481 compounds were screened per commercialized product in 1967 (NACA, 1970). By 1970, the average number of products screened had increased to 7,430 (NACA, 1970), and in 1976 an industry spokesman stated that from 8,000 to 15,000 chemicals were screened for each commercialized product (Goring, 1977). As stated in the Kline Guide to the Chemical Industry, "the cost of discovery and successfully introducing new products is increasing rapidly since most chemicals already synthesized have now been screened for their pesticidal properties (Nobel, 1974)."

Another reason for the shift away from basic R&D concerns the risk of finding environmental problems with a chemical product after it is marketed, e.g., Monsanto's Cycle-Safe bottles. Since experiments include neither the

FIGURE 6

Registration-Related and Total R&D Expenditures per Company, 1970-1976



SOURCE: EPA calculations from data in: NACA, "Industry Profile Study", 1971, 1975, 1976.

volume of product that will be introduced to the environment nor the variety of ways or geographic locations of product-environment interaction realized after the product is marketed, environmental hazards cannot always be predicted with accuracy. This risk is considerably reduced for chemicals previously marketed, since they have already passed this marketplace test.

For new chemicals there is also the risk of greater economic loss if a new pesticide is removed from the market. When a product is removed from the market, the manufacturer must absorb a loss on the production and distribution costs associated with the product in addition to the research and development costs. Both R&D costs and production costs are likely to be higher for a new pesticide than for a new use of an existing pesticide. For a new pesticide, at least screening costs will be incurred in addition to the R&D costs associated with developing either a new chemical or a new use for a currently used chemical. In addition, the cost of designing and constructing production facilities for a new chemical are likely to be greater than for a new use of an existing chemical.

Consequently, the trend among pesticide manufacturers is less reliance on the strategy of developing a new pesticide, patenting it and pricing it at a premium for those years before competition sets in and more on the strategy of finding new uses and specialty markets for chemicals which are already being marketed.

When a pesticide is removed from the market by EPA via cancellation/suspension, a market is automatically generated for substitutes to fill the void. Such major actions to date (DDT, aldrin, dieldrin, mercury, chlordane/heptachlor) have taken an equivalent of approximately 5 percent of U.S. total usage of pesticides (active ingredient basis) off the market (Aspelin, Gaede, and Luttner, September 1976).

Time Required for Pesticide R&D for New Products

Offsetting the impact of increased registration-related R&D expenditures is the recent decline in the average length of time between discovery and final registration. After a peak of 97 months in 1974/1975, the elapsed time fell by almost 2 years, to 74 months. This is less than the average elapsed time of 77 months in 1970 (NACA, 1973, 1975, 1976).

Year	Average Elapsed Time for Discovery to to Final Registration
1970	77
1973	80
1974/75	97
1975	93
1976	74

Quotations about Pesticide Research and Development

The following page contains quotations about pesticide R&D from trade publications and government reports.

These quotations indicate that traditional basic pesticide R&D has reached a stage of diminishing returns. Consequently, screening activities are becoming less random and more directed towards specific market opportunities, as are other aspects of R&D.

Addressing the issue of agency use of data in its files when considering registration applications, Patricia Wald argued that history contradicts the industry contention that unrestricted use of this data is a deterrent to investment in pesticide R&D.

Quotations about Pesticide Research and Development

Source	Remarks	Source	Remarks
Chemistry in the Economy, American Chemical Society, 1973, p. 241	"Profits are restricted, moreover, by the nature of patent law combined with the long gestation period for new pesticides. The world market for pesticides is still expanding profitably but is growing steadily more competitive. Because of these factors, many experts feel that research and development on new pesticides already is subject to diminishing returns."	Goring, ed., Kline Guide to the Chemical Industry, 1974, p. 143	"Much of the past success of the industry has been due to the introduction of more specific and higher-priced products. However, the cost of discovering and successfully introducing new products is increasing rapidly since most chemicals already synthesized have now been screened for their pesticidal properties."
Stanford Research Institute, New Innovative Pesticides: An Evaluation of Incentives and Disincentives for Commercial Development by Industry, prepared for OPP, EPA, May 1977, p. 1	"A transition in research from random-screening techniques to a more sophisticated approach incorporating targeted searches for control products that act on specifically identified biochemical or physiological processes within target organisms appears to be under way within the chemical industry. This reflects acknowledgement that random screening may be approaching a point of diminishing returns, and that a more sophisticated understanding of mode-of-action characteristics will probably be required for future successes, particularly in insecticide development."	"Pesticide Research in Europe," Farm Chemicals, Sept. 1973	"But developing new and interesting pesticide products is not as easy as it was." "There are some 500 pesticidal compounds available to the farmer and these first and second generation pesticides mean that any new candidates must be developed for specific market opportunities. This in turn means that pesticide research is increasingly product and market oriented with less emphasis on basic or innovative research." "A previous survey (FC, Sept. 1970) showed much the same trend in the United States."
Patricia M. Wald, Assistant Attorney General, in Senate Rep. No. 95-334, p. 90	"The pesticide industry existed from 1947 through 1972 without any legislation protecting the confidentiality of registration data - a period during which the USDA and its successor, the EPA, freely and openly referred to all data in connection with application for registration of pesticidal formulations similar to those previously registered. If there was a disincentive toward research and development, it did not manifest itself in any decline in new pesticide registrations."		

R&D COMPETITIVE ENVIRONMENT

The pesticide industry at the basic producer level is highly concentrated or oligopolistic, i.e., individual firms have important shares of the various pesticide markets. These market shares allow them to assert themselves by influencing price, quality and quantity of pesticides available. Market power such as evidenced in the basic producers of pesticides generally comes about because of barriers to entry into the market by other firms. Barriers to entry include such factors as patent protection and a requirement for large initial investment. The basic pesticide producing industry has both of these factors involved.

In 1970, seven firms accounted for 63 percent of U.S. pesticide sales, indicating the degree of concentration in the pesticide industry (NACA, 1970). Furthermore, a market survey conducted for EPA by Doane Agricultural Service showed that, for many major crops, 8 or fewer insecticides and 8 or fewer herbicides account for 75% of the respective markets. In some crops, including corn, cotton, and soybeans, 4 insecticides account for 75% of the insecticide markets for those crops (see Table 11) (Doane Agricultural Service, 1976). Competition in these markets is further reduced in the geographical submarkets of each market, e.g., the markets are even more concentrated at the state level than at the national level.

Of 82 companies registered with ITC in 1974 as pesticide and related products manufacturers, about 30 supported pesticide research staffs and submitted registration data to EPA. These companies are generally large, multi-product firms which can support the long-term studies of hazard which are required (ADL, 1975).

Table 11

Concentration in Pesticide Markets

Commodity	Herbicides		Insecticides	
	Market Share Leading Active Ingredient percent	Number Active Ingredients Comprising 75 percent of Market	Market Share Leading Active Ingredient percent	Number Active Ingredients Comprising 75 percent of Market
Corn 1/	47.2	6	37.3	4
Cotton 1/	40.5	7	45.0	4-6
Soybeans 1/	30.7	5	24.3	4-8
Wheat 2/	50.2	4-6	--	--
Peanuts 2/	32.8	4	17.4	9
Tobacco 2/	35.0	3	27.7	6-8
Potatoes 2/	55.6	2	21.1	6
Tomatoes 2/	32.0	4	28.8	4-6

1/ Estimated 1975 level.
2/ 1973-74 average.

Source: Derived from Doane Agricultural Service, "Current Pesticide User Profiles for Selected Pesticide Intensive Crops," 1976 (Nonproprietary data)

R&D expenditures are highly concentrated among a few firms. Of 33 firms reporting 1967 R&D expenditures to NACA, seven accounted for 46 percent of all pesticide R&D expenditures. This concentration appears to be increasing, as in 1970, seven firms accounted for 50 percent of R&D expenditures (NACA, 1970).

Exclusive use of data functions as a barrier to entry, benefiting those companies with existing R&D programs to the detriment of smaller firms wishing to enter a market. If companies which submit data to EPA are allowed exclusive use of these data, smaller companies wishing to enter the market will either be prevented from entering or forced into wasteful duplication of the data with their own research.

In addition, an exclusivity provision would prevent EPA from implementing a workable generic standards program. Such a program has the benefit of streamlining the EPA registration process and enhancing the competitive aspects of the pesticide industry by making it easier for small firms to gain entry to the market.

The lack of an exclusive-use-of-data provision in FIFRA does not represent the loss of a traditional privilege. Rather, its addition to FIFRA would represent a special privilege to the pesticide industry which is not enjoyed by other industries and has only been enjoyed by the pesticide industry on a de facto basis since the passage of FEPCA in 1972. Prior to 1972, EPA and USDA before it, utilized any test data in its files when processing registration applications.

Exclusive use of data was first proposed by NACA during the debate over amendments to FIFRA in 1971, based on the argument that "the then-current EPA practice of allowing applicants to rely on data developed by the original registrant was causing pesticide firms to abandon their research and develop-

ment programs (Senate, July 1977)". The proposal was defeated at that time because it would restrain trade, providing monopoly-like power to companies for several years after the patent period had expired (Senate, July 1977).

Essentially, exclusive use of data does not become useful to a company until after one of its products no longer has patent protection. Patent protection is a barrier to entry which gives its holder greater control over competition than an exclusive-use-of-data provision would. When a product is patented, a competitor must be licensed by the patent holder before producing the product. Under a situation where an exclusive-use-of-data provision exists, but no patent, a competitor can enter the market if willing to fund the research needed to develop the product and obtain a registration. Thus, while exclusive use of data is a barrier to entry, it is effective only for products which have been on the market so long that their patents have expired.

Recently, the Department of Justice addressed the issue of exclusive use of data in the pesticide industry, and found it to provide patent-like protection and, therefore, objectionable on legal grounds. In a June 1977 letter to Senator Patrick J. Leahy, Particia Wald, Assistant Attorney General, stated, "We . . . find the extension of patent protection inconsistent with long-standing law accommodating the patent laws with our system of free competition. The courts have held that the patent grant, as an exception to the competitive system's general prohibition of monopolies, must be strictly confined to its boundaries." "Any proposal having the effect of extending the patent protection beyond the statutory period would be inconsistent with

existing law and with the spirit of free competition. Furthermore, since the inception of our patent laws, Congress has provided a single period of patent protection for all industries. We see no reason for a special exception for the pesticide industry."

In conclusion, the pesticide industry has no need of the special privilege of exclusive use of data. The industry is already highly concentrated and such privilege will only further reduce competition in the industry, eventuating in higher consumer prices for pesticides. Furthermore, the Department of Justice argues that the courts have taken a strong stand against this type of privilege, routinely striking down attempts to extend patent protection.

SURVEY OF FINANCIAL/MARKET DATA ON MAJOR PESTICIDE MANUFACTURERS

A review of financial and market data for domestic pesticides manufacturers indicates that most are experiencing favorable economic outcomes and are expected to do so in the future. Most of the 17 firms reviewed in Table 12 indicate good to excellent overall future economic prospects based on available data. No firms are known to face highly negative prospects.

Table 12

Survey of Financial/Market Data on Major U.S. Domestic Pesticide Manufacturers

Name of Company	Type of Company[1]	Relative Importance Of Pesticides To Firm[2]	Principal Focus of Pesticide Business	Sales Trend[3]	Profit Trend[3]	Changes in Pesticides Business Activity[4]	Overall Economic Prospects Of Firm[4]
Shell	Oil	Minor	Insecticides	Up	Up	Significant research effort underway - construction of new plants.	Excellent
Dupont	Chemical	Minor	Fungicides Insecticides Herbicides	Up	Mixed	Record sales in agric-chemicals particularly in insecticides.	Good
Union Carbide	Chemical	Minor	Herbicides	Up	Mixed	Dedicated to agricultural chemicals. Russell Train appointed director. Amchem was acquired in 1977.	Good
Dow	Chemical	Minor	Herbicides Insecticides Fungicides	Up	Up	Highly successful/expanding	Excellent
Monsanto	Chemical	Minor	Herbicides Insecticides	Up	Up	Demand for agricultural chemical will lead to sales advance.	Excellent
Uniroyal	Tire	Minor	Fungicide	Steady	Down	Growth expected in agric./chemicals	Fair
FMC	Chemical	Minor	All pesticides	Up	Mixed	Favorable in pesticides	Good
American Cyanamid	Chemical	Minor	All pesticides	Up	Mixed	Promising new herbicides. Insecticides have growing markets. New plants under construction.	Good
Hercules	Chemical	Minor	Insecticides	Steady	Mixed	Uncertain in pesticides	Fair
Diamond Shamrock	Chemical	Minor	Fungicides Herbicides Insecticides	Up	Up	Prospects favorable	Excellent
Eli Lilly	Drug	Minor	Herbicides	Up	Up	Expanding/extensive development	Excellent
Kohm & Haas	Chemical	Major	Fungicides Herbicides Miticides	Steady	Down	Prospects severely curtailed in pesticides by EPA decision to review all new uses.	Fair
Stauffer	Chemical	Major	Herbicides Insecticides Fungicides	Up	Up	Increases in market share of pesticides	Excellent
Pennwalt	Chemical	Major	Insecticides	Up	Up	Strong sales gain over 1975.	Excellent
Chevron (Std. of CA)	Oil	Minor	All Pesticides	Up	Up	Steady sales gains	Excellent
Northwest Industries (Velsicol)	Conglomerate	Minor	Insecticide	Up	Up	Pesticide sales set new record but chlordane and heptachlor registrations under cancellation proceedings.	Excellent
Upjohn	Drug	Minor	Herbicides Fungicides	Up	Steady	Agricultural products sales are rising but earnings are mixed with three years of profits, two of losses in the last five years.	Good

1/ Forbes Classification "Forbes 30th Annual Report on American Industry", January 9, 1978.
2/ SEC Reports, Standard & Poors, International Trade Commission. (major: 20% or more of sales, minor: less than 20% of sales)
3/ Standard & Poors Stock Market Reports and company annual reports.
4/ Based on above sources.

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HOUSE OF REPRESENTATIVES
PROPOSED AMENDMENT
TO SECTION 3(c)(1)(D)
OF FIFRA

APPENDIX I

ECONOMIC ANALYSIS BRANCH
CRITERIA AND EVALUATION DIVISION
OFFICE OF PESTICIDE PROGRAMS

FEBRUARY 15, 1978

USE OF DATA TO SUPPORT REGISTRATION:
ADDITIONAL DATA TO SUPPORT EXISTING REGISTRATION

Sec. 2. (a) Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, is amended by--

(1) in subsection (c)(1), redesignating existing subparagraph (F) as (G), and amending subparagraph . . . (E) and adding a new subparagraph (F), such subparagraphs . . . (E), and (F) to read as follows:

"(E) if relied upon by the applicant, data first submitted to the Administrator after January 1, 1970, by another applicant to support an application for registration or for an experimental use permit, or to satisfy a request by the Administrator: *Provided,* That such data shall not, without the written permission of the original data submitter, be considered by the Administrator to support an application by another person, except--

"(i) in the case of data originally submitted to support an application for an experimental use permit or for registration of a new pesticide product, the Administrator may consider the data to support another person's application for registration after passage of a period of five years following the date the Administrator first issues a registration, to the extent permitted by subparagraph (F) of this subsection;

"(ii) in the case of data submitted in support of an application for an amendment adding a new use or uses to an existing registration and which pertains solely to such new use, such data may be considered in support of another person's application for registration after passage of a period of five years following the date the Administrator first registered the pesticide, to the extent permitted by subparagraph (F) of this subsection; and

"(iii) in the case of data requested by the Administrator and first submitted to support or maintain in effect an existing registration or to support reregistration, the Administrator may consider the data to support another person's application for registration after passage of a period of five years following the date of submission, to the extent permitted by subparagraph (F) of this subsection;

"(F) an offer to compensate the original data submitter, during the five-year period commencing immediately upon the expiration of a period of exclusive use, for an item of data under subparagraph (E)(i), (ii), or (iii) of this subsection. The Administrator may, without the permission of the original data submitter, consider such item of data in support of an application for registration by any other person (hereinafter in this subparagraph referred to as the 'applicant') only if the applicant has submitted to the Administrator such offer accompanied by evidence of delivery to the original data submitter of the offer.

(b) The amendments to section 3(c)(1)(D), (E) and (F) of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, made by this section shall apply with respect to all applications for registration or reregistration approved on or after the date of enactment of this amendment.

PESTICIDE INDUSTRY ENTRANCES AND EXITS BASED ON ITC REPORTS OF PRODUCTION AND SALES OF PESTICIDE AND RELATED PRODUCTS

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APPENDIX II

ECONOMIC ANALYSIS BRANCH
CRITERIA AND EVALUATION DIVISION
OFFICE OF PESTICIDE PROGRAMS
U.S. ENVIRONMENTAL PROTECTION AGENCY

JANUARY 27, 1978

FIRMS APPEARING ON U.S. INTERNATIONAL TRADE COMMISSION
DIRECTORY OF MANUFACTURERS, PESTICIDES AND RELATED PRODUCTS, 1972-1976

Firm	1972	1973	1974	1975	1976
Abbot Laboratories	X	X	X	X	X
Allied Chemical Corp., Agricultural Division	X	X	X	X	X
American Cyanamid Company	X	X	X	X	X
Alco Chemical Corp.	X	X	X	X	X
Alpha Laboratories, Inc.	X	X	X	X	X
Amchem Products, Inc.	X	X	X	X	X
Kerr-McGee Corporation	X	X	X	X	X
Arapahoe Chemical Inc.	X	X[3]	X	X	X
Ansul Chemical Company	X	X	X	X	X
Millmaster Chemical Co., Div. of Kewanee Industries, Inc.	X	X	X	X	X[8]
Buckman Labs, Inc.	X	X	X	X	X
Occidental Chemical Company	X				
Cincinnati Milacron Chemicals, Inc.	X	X			
Ciba Geigy Corp. and Ciba Agricultural Co.	X	X	X	X	X
Chemical Formulators, Inc.	X	X	X	X	X
Mobay Chemical, Chemagro Division	X[1]	X	X[6]	X	X
W.A. Cleary Corp.	X	X	X	X	X
Upjohn Co., Fine Chemicals Division	X	X	X	X	X
E.F. Houghton + Company	X	X	X	X	X
Diamond Shamrock Corp.	X	X	X	X	X
Dow Chemical Company	X	X	X	X	X
E.I. Dupont deNemours + Company	X	X	X	X	X
Eagle River Chemical Corp.	X	X	X	X	X
Ferro Corp., Ferro Chemical Division	X	X	X	X	X
Fisher Chemical Co., Inc.	X				

FIRMS APPEARING ON U.S. INTERNATIONAL TRADE COMMISSION
DIRECTORY OF MANUFACTURERS, PESTICIDES AND RELATED PRODUCTS, 1972-1976

Firm	1972	1973	1974	1975	1976
FMC Corp: Agricultural Chemicals Division	X	X[4]	X	X	X
Industrial Chemicals Division	X[2]	X	X		
Fairmount Chemical Company	X	X	X	X	X
Vulcan Materials Co., Chemical Division	X	X	X	X	X
GAF Corp., Chemical Division	X	X	X	X	X
Gulf Oil Corp., Gulf Oil Chemical Co., United States	X	X	X	X	X
Guth Chemical Company	X	X	X	X	X
Great Lakes Chemical Corporation	X	X	X	X	X
Hooker Chemical Corporation	X	X	X	X	X
Tenneco Chemicals, Inc.	X	X	X	X	X
Hercules, Inc.	X	X	X	X	X
International Minerals + Chemical Corporation	X	X			X[9]
Eli Lilly + Company	X	X	X	X	X
Mallinckrodt Chemical Works	X	X	X	X	X
Michigan Chemical Corporation	X	X	X	X	
Mooney Chemical Corporation	X	X	X	X	X
McLaughlin, Gormley + King Company	X	X	X	X	X
Monsanto Company	X	X	X	X	X
Motomco, Inc.	X	X	X	X	X
Merck + Company, Inc.	X	X	X	X	X
Morton Chemical Company	X	X	X	X	X
Montrose Chemical of California	X	X	X	X	X
Nease Chemical Co., Inc.	X	X	X	X	X
Niklor Chemical Company		X	X	X	X
Olin Matheson Chemical Corp. and Agricultural Division	X	X	X	X	X

FIRMS APPEARING ON U.S. INTERNATIONAL TRADE COMMISSION
DIRECTORY OF MANUFACTURERS, PESTICIDES AND RELATED PRODUCTS, 1972-1976

Firm	1972	1973	1974	1975	1976
Chevron Chemical Company	X	X	X	X	X
Story Chemical Company	X 5/	X	X	X	X
Pennwalt Chemicals Corporation	X	X	X	X	X
Gordon Corporation	X	X			
CPC International, Inc., Penwick Division	X	X	X	X	X
Pfizer, Inc.	X	X	X	X	X
Pierce Organics, Inc.	X	X	X	X	X
PPG Industries, Inc.	X	X	X	X	X
Reichold Chemicals, Inc.	X	X	X	X	X
Rhodia, Inc.	X	X	X	X	X
Rohm + Haas, Co.	X	X	X	X	X
Riverdale Chemical Company	X	X	X	X	X
Stauffer Chemical Co., Agricultural Division	X	X	X	X	X
Shell Oil Co., Shell Chemical Co. Division	X	X			
Sheperd Chemical Company	X	X	X	X	X
Mobil Oil Corp., Mobil Chemical Co. Div., Industrial Chem. Div.	X	X	X	X	X
Thompson-Hayward Chemical Company	X	X	X	X	X
Troy Chemical Company	X	X	X	X	X
Union Carbide Corporation	X	X	X	X	X
Universal Oil Products Co. UOP Chemical Division	X	X			
Pfister Chemicals, Inc.	X	X	X	X	X
Uniroyal, Inc., Chemical Division	X	X	X	X	X
Velsicol Chemical Corporation	X	X	X	X	X
Vineland Chemical Company	X	X	X	X	X
Vanderbilt Chemical Company	X	X	X	X	X

FIRMS APPEARING ON U.S. INTERNATIONAL TRADE COMMISSION
DIRECTORY OF MANUFACTURERS, PESTICIDES AND RELATED PRODUCTS, 1972-1976

Firm	1972	1973	1974	1975	1976
Witco Chemical Co., Inc.	X	X	X	X	X
Phillips Petroleum Company	X	X	X	X	X
Pike Chemicals, Inc.	X	X	X	X	X
Stauffer Chemicals, Calhio Chem., Inc. Division	X	X	X	X	X
Valchem	X				
Ventron Corp., Ventron Chemicals	X	X			
Sandoz, Inc.		X	X1/	X	X
Salsbury Laboratories		X			
Sobin Chemical Company		X	X	X	
Ashland Oil, Inc., Ashland Chemical Co. Division		X	X	X	X
Interstab Chemical, Inc.			X	X	X
Lakeway Chemicals, Inc.			X	X	X
Nalco Chemical Company			X	X	X
R.S.A. Corporation			X		
Greenwood Chemical Company				X	X
Pelron Corporation				X	X
Martin-Marietta Corp., Sodvco Division				X	
Vinings Chemical Company				X	X
Vicksburg Chemical Company, Sub of Vertac Consolidated				X	X
Kay-Fries Chemicals, Inc.					X
Parke Davis + Co., Sub of Warner Lambert Company					X

FIRMS APPEARING ON U.S. INTERNATIONAL TRADE COMMISSION
DIRECTORY OF MANUFACTURERS, PESTICIDES AND RELATED PRODUCTS, 1972-1976

Firm	1972	1973	1974	1975	1976

1/ Prior to 1971, Chemagro Corp.
2/ Prior to 1972, Organic Chemicals Division
3/ Prior to 1973, Arapahoe Chemical Division, Syntex Corp.
4/ Prior to 1973, Niagra Chemical Division
5/ Prior to 1972, Ott Chemical Company
6/ Prior to 1974, Baychem Corp., Chemagro Division
7/ Prior to 1974, Sandor-Wander, Inc.
8/ Prior to 1976, Millmaster-Onyx, Corp.
9/ Prior to 1976, International Minerals + Chemical Corp.

SOURCE: U.S. International Tariff Commission, U.S. Production and Sales of Pesticides and Related Products, for years 1972 through 1976

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